

seconds and then shut off. If you don't hear it run, check the fuel pump fuse in the fuse block.

One last thing. Have your assistant start your car so that you can watch what's happening in the engine compartment. And keep a fire extinguisher handy—just in case the need arises.

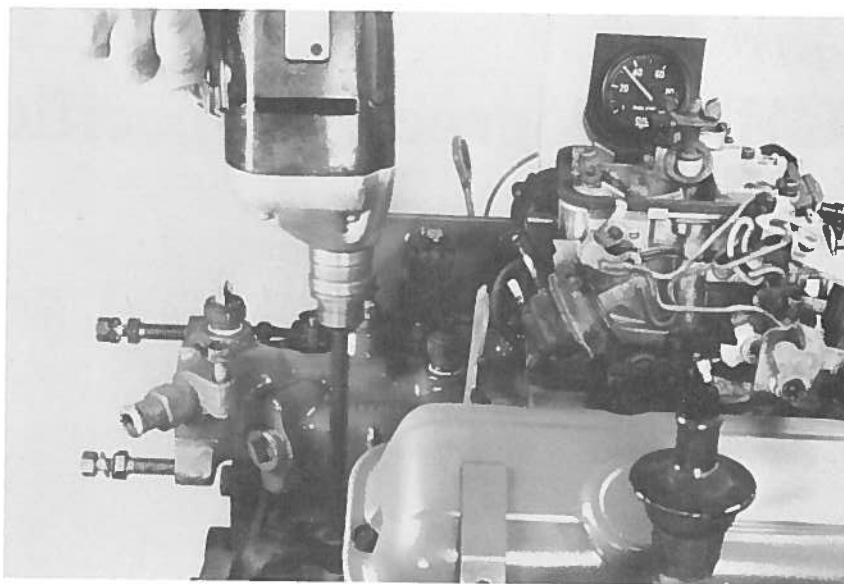
Starting Your Newly Rebuilt Engine

Now that you've got the engine in and everything connected, you want to jump in and fire it up. That's understandable, but you need to keep your emotions in check for at least a few minutes more. This will give you time to double-check your work to ensure that the engine truly is ready to come to life once again. If you have any friends left after borrowing their tools, garage, or whatever, ask one to watch for any "surprises" that may occur when the engine starts running, such as a gas line or oil leak or a radiator cooling fan that isn't working.

It's best to have the exhaust system connected and fully operational before you start the engine, as this will allow you to listen for any unusual noises as the engine starts and runs. You also must check the operation of the throttle. It must return to the fully closed position, or you may have a V-6 hand grenade in the engine compartment rather than an engine. If the throttle doesn't fully close, the cable may be kinked or the return springs may be missing from the lever or not attached to the engine.

As your friend tries to start the engine, be ready at the distributor. If the engine doesn't start in about 3sec or so, and if it doesn't sound like it will, stop cranking the engine. This will save wear and tear on the cam and lifters if they're new. Then put your hand around the middle of the distributor cap, halfway between the spark plug wires and metal housing, rotate the distributor a few degrees, and have your friend try again. If it coughs and sputters, try rotating the distributor in that direction until it starts.

If it doesn't sound like it's going to start, try turning the distributor in the opposite direction. If it still doesn't start, stop cranking and check the position of the distributor cap rotor. It should line up with the #1 spark plug wire terminal in the distributor cap



Prime the engine to prevent excessive wear during engine start-up.

when the piston in cylinder #1 is at TDC. If it's within 1/4in or so, just rotate the distributor until it aligns. If it's farther away than this, you'll have to remove the distributor and rotate its shaft until you get a satisfactory alignment. If the engine still won't start, you may have installed the distributor 180deg out of position. Check for this by following the procedure outlined in the "Distributor/Oil Pump Drive" section of Chapter 6.

As soon as the engine starts, run it at 2000–4000rpm. Engine oil pressure should be at least 40psi with 10W30 in the crank-case. If it isn't, stop the engine immediately. Unfortunately, if the oil pressure is this low and all the galley plugs are in, the oil pump is bad or there is excessive bearing clearance. If you don't have a tachometer, run the engine at an extra-high idle as this should be about 2000rpm. As you're running the engine, be sure to raise and lower the rpm between 2000 and 4000 to vary the loading of the engine components. This ensures a proper break in.

After the engine is started, it may smoke. A moderate amount of smoke can be expected if the engine has been freshly painted, because the enamel smokes as it's cured by engine heat. An engine will also smoke if oil has spilled on the exhaust system or if the exhaust system is new. This is normal and no cause for alarm, but if

the smoke lasts more than five minutes, or it's in tremendous volume, something is probably wrong. Stop the engine immediately and find the cause of the problem.

Strange and/or unusual noises are another concern. Clicking noises in the area of the valve covers can signal a valvetrain problem—typically, loose rocker arms. However, the fuel injectors in an MPFI engine make a clicking noise as they open and close. Don't mistake this noise for a valvetrain problem.

As the engine runs, have your friend keep an eye on the coolant temperature gauge, oil pressure gauge, and tachometer. Engine temperature shouldn't rise above 220degF. If it does, place an electric fan in front of the radiator to provide additional cooling. If the engine temperature still rises, shut the engine off. When the engine has cooled, carefully check the coolant level and for any leaks that may have caused the elevated temperature.

The First Oil Change

After the engine has been run 25min or so, you'll need to change the engine oil filter. That's because the moly-lube you used on the camshaft, lifters, and other internal parts will completely plug an oil filter in about 30min of engine operation.

Appendix

GM 60-Degree V-6 Specifications

General & Component Specifications

	2.8L V6	3.1L V6
Bore x Stroke	3.503inX2.992in (89mmX76mm)	3.503inX3.312in (89mmX84mm)
Firing Order	1-2-3-4-5-6	1-2-3-4-5-6
Bearing Clearances		
Main	0.0015-0.0025in (0.038-0.064mm)	0.0015-0.0025in (0.038-0.064mm)
Rod	0.0011-0.0025in (0.028-0.064mm)	0.0011-0.0025in (0.028-0.064mm)
Connecting Rod Side Clearance	0.008-0.020in (0.20-0.51mm)	0.008-0.020in (0.20-0.51mm)
Camshaft		
Lift		
Intake	0.231in (5.86mm)	NOT USED
Exhaust	0.262in (6.65mm)	NOT USED
<i>Note: Cam above used on early base 2.8L V6's & some S10's & Camaros</i>		
Intake	0.262in (6.65mm)	0.262in (6.65mm)
Exhaust	0.273in (6.94mm)	0.273in (6.94mm)
Journal Clearance	0.001-0.0025in (0.026-0.063mm)	0.001-0.0025in (0.026-0.063mm)
Crankshaft Main Journals		
Small journal		
#1, #2 & #4 Journals	2.4937-2.4946in (63.340-63.364mm)	NOT USED
#3 Journal	2.4932-2.4941in (63.327-63.351mm)	NOT USED
Large Journal	2.647-2.648in (67.241-67.265mm)	2.647-2.648in (67.241-67.265mm)
Taper (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Out-Of-Round (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Crankshaft Rod Journals		
Small Journal		
Large Journal	1.998-1.999in (50.758-50.784mm)	1.998-1.999in (50.758-50.784mm)
Taper (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Out-Of-Round (maximum)	0.0002in (0.005mm)	0.0002in (0.005mm)
Crankshaft End Play	0.0024-0.0083in (0.06-0.21mm)	0.0024-0.0083in (0.06-0.21mm)
Cylinder Bore		
Diameter	3.503-3.506in (88.992-89.070mm)	3.5046-3.5053in (89.016-89.034)
Taper (maximum)	0.0008in (0.020mm)	0.0008in (0.020mm)
Out-Of-Round (maximum)	0.0008in (0.020mm)	0.0008in (0.020mm)
Piston-To-Bore Clearance	0.0007-0.0017in (0.017-0.043mm)	0.0009-0.0022in (0.0235-0.0565)
Oil Pressure (Engine @ Normal Operating Temp) 30-55psi @ 2000rpm (205-380kPa @ 2000rpm)		
Piston Ring End Gap Clearance		
Top Compression	0.010-0.020in (0.25-0.50mm)	0.010-0.020in (0.25-0.50mm)
Second Compression	0.010-0.020in (0.25-0.50mm)	0.010-0.020in (0.25-0.50mm)
Oil Rails	0.011-0.030in (0.27-0.75mm)	0.010-0.030in (0.25-0.75mm)
Piston Ring Side Clearance		
Top Compression	0.0012-0.0027in (0.030-0.070mm)	0.002-0.0035in (0.05-0.09mm)
Second Compression	0.0016-0.0037in (0.040-0.095mm)	0.002-0.0035in (0.05-0.09mm)
Oil (maximum)	0.008in (0.200mm)	0.008in (0.200mm)
Rocker Arm Ratio	1.50:1	1.50:1
Valve Stem Clearance	0.001-0.0027in (0.026-0.068mm)	0.0016-0.0025in (0.041-0.064mm)
Valve Spring Pressure		
Cast Iron Heads		
Valve Open	195lbs @ 1.18in (867Nm @ 30mm)	189lbs @ 1.20in (841Nm @ 30.5mm)
Valve Closed	88lbs @ 1.575in (391Nm @ 40mm)	80lbs @ 1.575in (356Nm @ 40mm)
Aluminum Heads		
Valve Open	215lbs @ 1.291 (956Nm @ 33mm)	
Valve Closed	90lbs @ 1.701 (400Nm @ 43mm)	

Valve Spring Installed Height	1.575in (40mm)
Cast Iron Heads	1.614in (41mm)
Aluminum Heads	1.575in (40mm)

Torque Specifications

AIR Tubing Nuts	18-20lb-ft	24-27Nm
Bellhousing-To-Engine Bolts	30-35lb-ft	40-47Nm
Clutch Pressure Plate-To-Flywheel Bolts	18lb-ft + 30	24Nm + 30
Camshaft Sprocket Bolts	16-20lb-ft	22-27Nm
Camshaft Rear Cover Bolts	84-96lb-in	9-11Nm
Connecting Rod Nuts	36-42lb-ft	49-57Nm
Cylinder Head Bolts (refer to text for procedure)		
Aluminum Heads	33lb-ft + 90	45Nm + 90
Cast Iron Heads	40lb-ft + 90	55Nm + 90
Distributor Hold-down Bolt	23-28lb-ft	31-38Nm
EGR Valve Nuts	16-20lb-ft	22-27Nm
Engine Mounting Nuts	28-32lb-ft	38-44Nm
Exhaust Manifold Bolts		
Aluminum Heads	16-20lb-ft	22-27Nm
Cast-Iron Heads	22-28lb-ft	31-38Nm
Flywheel Bolts	50-55lb-ft	68-74Nm
Flexplate Bolts	50-55lb-ft	68-74Nm
Intake Manifold Bolts (Carbureted)	15-18lb-ft	20-24Nm
Intake Manifold Bolts (Throttle Bodied)	15-18lb-ft	20-24Nm
Intake Manifold Bolts (Multi-Port Fuel Injected)		
Lower Plenum (refer to text for procedure)	16-18lb-ft	22-24Nm
Manifold	13-25lb-ft	18-34Nm
Main Bearing Cap Bolts	68-72lb-ft	92-97Nm
Oil Pan Bolts		
M8x1.25mm X 14mm	16-20lb-ft	22-28Nm
M6x1.00mm X 16mm	84-96lb-in	9-11Nm
Oil Filter Adapter Bolt	61-65lb-ft	80-90Nm
Oil Pan Drain Plug	16-20lb-ft	22-27Nm
Oil Pan Stud	72-84lb-in	8-9 Nm
Oil Pump Mounting Bolt	28-32lb-ft	38-43Nm
Oil Pump Cover Screws	72-96lb-in	8-11Nm
Rocker Arm Cover Bolts	72-96lb-in	8-11Nm
Rocker Arm Nut (Non-adjustable)	15-20lb-ft	20-27Nm
Rocker Arm Studs	46-50lb-ft	62-68Nm
Spark Plugs		
Aluminum Heads (Apply anti-seize to threads)	18-22lb-ft	22-30Nm
Cast-Iron Heads	22-25lb-ft	30-34Nm
Thermostat Housing Bolts	16-18lb-ft	22-24Nm
Timing Chain Case		
10mm Bolts	34-40lb-ft	46-54Nm
8mm Bolts	20-24lb-ft	26-34Nm
Timing Chain Damper Bolts	13-17lb-ft	18-23Nm
Torsional Damper Center Bolt	67-73lb-ft	90-99Nm
Water Pump Bolts		
M6 x 1.00mm x 25mm	72-96lb-in	8-11Nm
M8 x 1.25mm X 70mm	16-20lb-ft	22-27Nm
M10 x 1.50mm X 75mm	30-35lb-ft	41-47Nm
Water Pump Nut	72-96lb-in	8-11Nm

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